UNITED STATES DISTRICT COURT

DISTRICT OF MASSACHUSETTS

FEDERAL HOME LOAN BANK OF BOSTON,
 	
                                                Plaintiff,
 	
              v.
 	
ALLY FINANCIAL, INC. f/k/a GMAC LLC, et al.
 	
                                           Defendants
	Case 1:11-cv-10952-GAO

EXPERT DECLARATION OF ROY E. WELSCH, Ph.D.

March 7, 2014

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I.   Qualifications

1. I am the Eastman Kodak Leaders for Global Operations Professor of Management and the
    Head of the Management Science Area at the Massachusetts Institute of Technology ("MIT")
    Sloan School of Management. At MIT, I teach courses in applied statistics and data analysis
    focusing on regression modeling, data-mining, experimental design, sampling, and quality
    control with financial and marketing applications. I am a Fellow of the Institute of
    Mathematical Statistics, the American Statistical Association, and the American Association
    for the Advancement of Science.

2. I have been a Professor of Statistics and Management Science at MIT since 1979 and a
    Professor of Engineering Systems at MIT since 2005. Prior to that, I held positions as an
    Assistant Professor and then Associate Professor from 1969 to 1979. I was a Leaders for
    Manufacturing Professor at MIT from 1988 to 1993. I received my Ph.D. in Mathematics
    from Stanford University, where I was a National Science Foundation Graduate Fellow and
    an Honorary Woodrow Wilson Fellow.

3. I have served as the Director of the MIT Statistics Center and as the Director of the MIT
    Center for Computational Research in Economics and Management Science. From 1973
    until 1978, I was a Senior Research Associate at the Computer Research Center for
    Economics and Management Science at the National Bureau of Economic Research.

4. I have researched and consulted extensively in the areas of statistics and management
    science. I co-authored (with Edwin Kuh and David Belsley) the book *Regression
    Diagnostics: Identifying Influential Data and Sources of Collinearity*. My academic
    research has been published in leading journals, including *Econometrica*, *Journal of the
    American Statistical Association*, *Annals of Statistics*, *Handbook of Econometrics*, *Journal of
    Business and Economic Statistics*, and *Computational Statistics and Data Analysis*. My
    current research focuses on robust estimation, credit scoring models and risk assessment, data
    visualization, diagnostics for checking model and design assumptions, variable selection in
    regression models, and volatility modeling in financial markets.

5. A copy of my curriculum vitae, including a list of cases in which I have testified as an expert
    at trial or by deposition during the last four years, is attached hereto as Appendix A.

II.   Assignment

6. I have been retained by counsel for the joint defense group[1] in the *Federal Home Loan Bank of Boston v. Ally Financial et al.* matter to review and respond to the expert declaration submitted by Charles D. Cowan on February 7, 2014[2] ("Cowan Declaration") on issues related to statistical sampling in the current matter. I understand that this action has been brought by Federal Home Loan Bank of Boston ("Bank" or "Plaintiff"), who purchased from Defendants 111 senior, triple-A-rated Private Label Mortgage-Backed Securities ("PLMBS" or "Certificates") backed by mortgage loans in 110 Supporting Loan Groups (the "SLGs"). I understand that Plaintiff seeks rescission and damages for alleged misrepresentations in the Offering Documents.[3]

7. My work in this matter, which I understand has yet to enter into fact discovery, is necessarily ongoing. I reserve the right to revise or supplement my opinions in light of any additional materials including data, documents, declarations of experts, and deposition or other testimony, or if I am asked to perform further research or analysis, whether on Dr. Cowan's present proposal or different proposals he may submit. A list of the documents that I have relied upon in forming my opinions is attached hereto as Appendix B.

8. I am being compensated in this matter at my current rate of $600 per hour. My compensation is not contingent upon my opinions or the outcome of this case. I have been assisted in the matter by staff of Cornerstone Research, who worked under my direction.

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[1] It is my understanding that defendants in this action include Barclays, Citigroup, Credit Suisse, Deutsche Bank / Mortgage IT, Impac, JPMorgan, Bear Stearns, WaMu Capital Corp., Morgan Stanley, Nomura, RBS, and UBS (collectively, "Defendants").

[2] Expert Declaration Of Charles D. Cowan, Ph.D. Regarding The Selection Of Statistically Reliable Random Samples Of Mortgage Loans for the Federal Home Loan Bank of Boston, Dkt. No. 394, February 7, 2014.

[3] According to the *Federal Home Loan Bank of Boston* v. *Ally Financial et al.* Amended Complaint for Rescission and Damages and Demand for Jury Trial, Dkt. No. 180 ("Complaint"), "Offering Documents" include "registration statements, free writing prospectuses, prospectuses, supplemental prospectuses, private placement memoranda and other written materials" with respect to the Certificates purchased by the Bank. (Complaint, ¶2)

III.   Summary of Opinions

9.   As detailed in the sections that follow, I find that Dr. Cowan has failed to provide important information which is necessary for a scientific assessment of his sampling proposal, and that his proposal, as presented, is flawed in several ways, which render it unreliable. In particular:

- For Dr. Cowan's sample size of 100 loans to provide a 95 percent confidence interval and a +/-10 percent maximum margin of error, the relevant inquiries to be addressed through sampling in the current matter must be binary,[4] meaning that they must be susceptible to two-category (*i.e.*, yes or no) answers.[5] It appears that Dr. Cowan's proposal assumes without basis that all such relevant inquiries, including the inquiry regarding alleged misrepresentations about the loan-to-value ("LTV") or cumulative loan-to-value ("CLTV") ratios, are binary, when in fact three or more, or continuous outcomes are likely. When there are three or more possible outcomes, Dr. Cowan's sample size calculations are not necessarily correct. I understand that whether or not the relevant inquiries are binary is an issue on which the parties disagree; therefore, it would have been more appropriate for Dr. Cowan to propose a sampling design after this issue was resolved.

- Dr. Cowan's statement that a +/-10 percent margin of error "strikes the correct balance between cost and accuracy"[6] is inconsistent with his prior practice of proposing a +/-5 percent maximum margin of error in other matters (*e.g.*, *MBIA v. Countrywide*). Dr. Cowan does not attempt to explain why he has proposed using different margins of error in different matters, and ignores that, according to his own finding, a margin of error of 2 percent instead of 10 percent is used in "sampling to test loan origination and servicing for FHA-insured loans."[7]

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[4] Or more generally, as shown in Exhibit 1, the variability or standard deviation of the variable of interest should be 0.5 or less.

[5] Cowan Declaration, ¶¶36, 52.

[6] Cowan Declaration, ¶54.

[7] Cowan Declaration, ¶48, Exhibit 4.

- A margin of error of +/-10 percent can potentially result in a range of estimates for the population that is too wide to be useful for some relevant inquiries. Dr. Cowan does not explain why he does not improve the precision—or the margin of error[8]—of his sample by incurring the cost to re-underwrite a larger sample where the benefits of greater certainty would outweigh those costs.

- Even though Dr. Cowan opined in the past that sampling without extrapolation is "meaningless" and that the "process of extrapolation of the results from the sample to the population is an integral part of the planning for and *acceptance* of sampling as a viable scientific method,"[9] he fails to provide an extrapolation method, which renders his proposal incomplete and premature. Dr. Cowan only states that "[d]ifferent estimates will require different estimation and extrapolation methods,"[10] but fails to articulate what population characteristics he intends to estimate and extrapolate from the sample and what specific extrapolation methodologies he may use. A description of extrapolation is critical to assess whether Dr. Cowan's proposal is scientifically sound, as the process and purposes of extrapolation may render Dr. Cowan's sample size and margin of error assumptions incorrect. For example, extrapolating from a sample to estimate the dollar amount of allegedly misrepresented loans or damages, if feasible, may require significant other considerations and potentially larger sample sizes, making sample sizes of 100 loans per SLG inadequate.

- Dr. Cowan claims that the selection of the extrapolation method will ultimately "[depend] on which method reduces the margin of error the most."[11] Dr. Cowan fails to consider that, should the estimates be biased (an estimate is biased when the expected value of the estimator is not equal to the true value in the population), choosing extrapolation methods based on the margin of error instead of other metrics

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[8] Dr. Cowan uses "precision" or "reliability" to measure the confidence level and the margin of error in sampling. Cowan Declaration, ¶34. I follow his terminology in this declaration.

[9] Expert Report of Charles D. Cowan, Ph.D. Regarding the Selection of Statistically Valid Random Samples of Mortgage Loans for Fifteen FHFA Actions in *FHFA v. J. P. Morgan*, October 10, 2012 (Ex. 2), ¶64 (emphasis added).

[10] Cowan Declaration, ¶67.

[11] Cowan Declaration, ¶67.

(*e.g.*, mean squared error) is unsound. Indeed, one of the estimators referenced in the Cowan Declaration for expository purposes, a ratio estimator for a continuous variable that incorporates data known from the loan tapes, can result in biased estimates. In any case, Dr. Cowan does not describe which estimators he would use or how different potential extrapolation methods would reduce the margin of error differently, nor does he provide any support for his contention that such a selection cannot be pre-specified before the sample loans are re-underwritten. His declaration as a result lacks critical details and reasoning necessary for a full assessment of whether his proposed methods are scientifically valid and reliable.

- Dr. Cowan's proposal of having a supplemental sample to address the problem of missing loan files is premature and incomplete. Dr. Cowan does not define what a missing loan file is or describe the circumstances under which a loan file will be considered "missing," which precludes an assessment of his proposal's reliability. Dr. Cowan also does not address fundamental statistical questions about how he will ascertain if the loan files are missing at random rather than not at random, and how his sampling methodology will account for any non-random missing loan files. Without knowing whether loan files will be missing randomly as opposed to non-randomly, there is no evidence that Dr. Cowan's sampling proposal will result in a truly random and unbiased sample of the population. Dr. Cowan ignores that, when loan files are not missing at random, observations from a sample of non-missing loan files cannot be extrapolated to make any inferences about a population of missing loan files. In other words, the results based on his samples will not be able to be reliably extrapolated to the entire population of loans composing the relevant SLG.

- Dr. Cowan states that he was instructed that the relevant populations are the SLGs for the Certificates that Plaintiff purchased.[12] As a result, Dr. Cowan does not address that more than half of the 110 SLGs had two or more originators. It is premature to treat SLGs rather than the originator-specific populations of loans composing the SLGs as the relevant sampling populations because, to the extent that loans within the

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[12] Cowan Declaration, ¶1.

same SLG have been originated by different originators who followed different underwriting guidelines or employed different underwriting practices, it may be necessary to draw the sample by originator so that there can be the desired sampling precision or reliability for each originator within an SLG. With this issue outstanding, Dr. Cowan should have either waited until it was determined before designing his methodology or taken the uncertainty into account by designing a methodology which would be equally as applicable should the samples be drawn by originator.

- Dr. Cowan chooses the FICO score as his only stratifying variable,[13] but fails to substantiate his assertion that the FICO score is correlated to defect rate or any other "outcome of interest" such that stratification can materially decrease the margin of error. Dr. Cowan also does not explain why stratification by any other loan characteristics would be inappropriate here, when in other actions his methodology has stratified samples by a number of loan characteristics, including the FICO score, CLTV ratio, and documentation type. [14]

- Finally, Dr. Cowan has failed to provide important details required for a third party to replicate his results, including the random number generating programs that will be used to select the random sample, as well as the data and computer programs associated with his representativeness tests and extrapolation methods. The failure to provide such information precludes a finding that his methodology is reliable. To the extent Dr. Cowan provides at a later date this and other critical information missing from the Cowan Declaration, it will likely require a reassessment of his methodology.

IV.   Background

10. The Cowan Declaration proposes drawing a sample of 100 loans from each SLG supporting each Certificate that Plaintiff purchased. It further states that Plaintiff plans to use sampling

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[13] Cowan Declaration, ¶5.

[14] See, for example, Affidavit of Dr. Charles D. Cowan in Further Support of Plaintiff's Motion *In Limine* Regarding Sampling, *MBIA Insurance Corporation v. Countrywide Home Loans Inc. et al.*, July 26, 2010 (Ex. 4).

"to establish that Defendants' statements in the Offering Materials were false or misleading in various regards," including:

- "(i) whether the mortgage loans were originated in compliance with applicable underwriting guidelines;"
- "(ii) whether the mortgaged properties were accurately appraised in compliance with applicable appraisal standards;"
- "(iii) the number/percentage of loans that had LTV and/or CLTV ratios above specified values; and"
- "(iv) the creditworthiness of the Securities."[15]

11. Dr. Cowan also claims that it will be "possible" to use sampling to determine alleged "misrepresentations and resulting liability in connection with the sale of each Certificate with a known level of accuracy," or even a "much higher level of confidence" in connection with the "sale of Certificates in all Securitizations."[16]

V.   Dr. Cowan's Proposal Does Not Take into Account That the Relevant Inquiries May Not Be Binary

12. According to the Cowan Declaration, a sample size of 100 loans is "sufficient" to test a binary question, or to compute an estimate of different "binomial (two category) statistics (such as defective or not defective)."[17] Dr. Cowan thus views the inquiries in the current matter regarding alleged misrepresentations and resulting liability as binary questions, but I understand that issue is in dispute.

13. As explained in Section IV above, Dr. Cowan outlines various inquiries Plaintiff intends to address through the use of sampling, including "(iii) the number/percentage of loans that had LTV and/or CLTV ratios above specified values." Dr. Cowan treats the relevant inquiries regarding LTV/CLTV ratios as a binary problem—either the ratio is above the specified value or it is not. This approach ignores that the Offering Documents, as I understand them,

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[15] Cowan Declaration, ¶26.

[16] Cowan Declaration, ¶72.

[17] Cowan Declaration, ¶¶36, 52.

often specify that the applicable underwriting guidelines allow for compensating factors where the LTV and/or CLTV ratios are above a specified value but another factor or factors compensate for that.[18] Under such circumstances, Dr. Cowan's treatment of the LTV and/or CLTV ratios as simple binary variables is scientifically unsound.

14. Dr. Cowan fails to describe how his proposed sample would determine "the number/percentage of loans that had LTV and/or CLTV ratios above specified values." Moreover, the Complaint alleges that the Offering Documents misrepresented "the extent to which loans in the pools underlying each Certificate had LTVs in excess of 100%, 90% or 80%, and the weighted average LTV of the pools."[19] Dr. Cowan does not establish that he will be able to draw a binary conclusion regarding the "extent" to which sample loans "exceed" these three different specified values, and it is even less clear how a binary conclusion should be made when the weighted average LTV of the pools is also considered. This is all information Dr. Cowan must put forward in order for his proposal to be considered scientific.

15. Fundamentally, if the relevant inquiry is not binary, but instead is susceptible to three or more possible outcomes, as some of these inquiries appear to be, then Dr. Cowan's sample size may fall far short of the goal of +/- 10 percent margin of error with a 95 percent confidence level.[20] If the sample is to be used to address a question regarding a continuous variable such as the LTV ratio or appraisal value, the variability of the LTV ratio and the appraisal value must be taken into consideration when determining the required sample size. For example, Exhibit 1 shows how the required sample size varies depending on the variability or standard deviation of the variable of interest. For a binary inquiry like whether or not a loan is defective, when the defect rate is equal to 50 percent, its standard deviation is 0.5. As also shown in Exhibit 1, when the standard deviation is 0.5, the necessary sample size for a 10 percent and a 5 percent margin of error is approximately 100 and 400,

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[18] For example, the Complaint cites the prospectus of one Certificate at issue, which states, "Exceptions to Countrywide Home Loans' underwriting guidelines may be made if compensating factors are demonstrated by a prospective borrower." Complaint, ¶842-E.

[19] Complaint, ¶876.

[20] Steven K. Thompson, "Sample Size for Estimating Multinomial Proportions," *The American Statistician* 41, no. 1 (February 1987) (Ex. 3).

respectively. However, with the higher standard deviation that could arise with a continuous variable, a sample size larger than 100 will be required even assuming a margin of error of 10 percent, a fact that Dr. Cowan completely ignores in his declaration.

16. Similarly, Dr. Cowan provides no details on what "(iv) the creditworthiness of the Securities" refers to or how he intends to use the sample to address the "creditworthiness of the Securities." According to the Complaint, ratings of the Certificates allegedly understate the "true risk of the PLMBS and overstate their creditworthiness."[21] I am not an expert on issues related to credit ratings or creditworthiness of the securities and do not intend to offer any opinions on these topics (nor am I aware of any credentials that would make Dr. Cowan qualified to opine on the creditworthiness of PLMBS), but if the "creditworthiness of the Securities" relates to the likelihood of delinquency and defaults in the underlying mortgage pools,[22] then Dr. Cowan fails to explain how his proposed sample will be used to draw conclusions about the delinquency or default probabilities, which are not binary but instead can take any value between zero and one.

17. Further, it is my understanding that there are many borrower, loan, and securitization characteristics that might be empirically related to loan or certificate performance. The greater the variation in these characteristics in a given SLG, the larger the sample one would need to determine whether purportedly misrepresented loans did, in fact, perform differently and may result in alleged rescission and damages. In fact, once the relevant inquiry is *not* a simple "binomial (two category) [statistic] (such as defective or not defective),"[23] the considerations for sample size and sample design could become much more complex. It is premature to discuss a sampling design when the purpose of the sampling has not been articulated and may evolve over time as more information becomes available. The Cowan Declaration is silent on these issues and thus cannot withstand scientific scrutiny.

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[21] Complaint, ¶13-c.

[22] Complaint, ¶13-c.

[23] Cowan Declaration, ¶52.

VI.   Dr. Cowan's Claim That a Maximum Margin of Error of +/-10 Percent "Strikes the Correct Balance between Cost and Accuracy" Is Flawed and Unsupported

18. Dr. Cowan states that for binary or "binomial (two category) statistics,"[24] a sample of 100 loans from each SLG will allow a 95 percent confidence level with a maximum margin of error of 10 percent. He claims that, at a 95 percent confidence level, a margin of error of 10 percent "strikes the correct balance between practical considerations (such as cost and time) and accuracy."[25] Dr. Cowan further argues that a margin of error of 10 percent "has been accepted by courts as scientifically valid in a number of actions"[26] and lists cases where a 10 percent margin of error has been "accepted or *proposed*."[27]

19. However, in other actions dealing with sampling of mortgage loans, a margin of error of less than 10 percent has been proposed by experts, including Dr. Cowan himself. For example, Dr. Cowan stated in *MBIA v. Countrywide* that:

> The size of each sample would be at least 400 loans as that number is sufficiently large to draw conclusions about the proportion of breaches of representations and warranties in the population with a confidence level of at least 95 percent with no more than a +/- 5 percent margin of error.[28]

20. Dr. Cowan does not explain why instead of the +/-5 percent margin he proposed in other matters (including *MBIA v. Countrywide*,[29] *Boilermakers et al. v. WaMu*,[30] and *FHLB-Chicago v. Banc of America*[31] as listed on page 7 of the Cowan Declaration), a margin of error of +/-10 percent is now adequate for the current matter. In the *Massachusetts Mutual v.*

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[24] Cowan Declaration, ¶52.

[25] Cowan Declaration, ¶54.

[26] Cowan Declaration, ¶5, n.3.

[27] Cowan Declaration, ¶5, emphasis added.

[28] Affidavit of Dr. Charles D. Cowan in Further Support of Plaintiff's Motion *In Limine* Regarding Sampling, *MBIA Insurance Corporation v. Countrywide Home Loans Inc. et al.*, July 26, 2010 (Ex. 4), ¶8.

[29] Affidavit of Dr. Charles D. Cowan in Further Support of Plaintiff's Motion *In Limine* Regarding Sampling, *MBIA Insurance Corporation v. Countrywide Home Loans Inc. et al.*, July 26, 2010 (Ex. 4), ¶8.

[30] Expert Report of Charles Cowan, Ph.D., *Boilermakers National Annuity Trust Fund et al. v. WaMu Mortgage Pass-Through Certificates, Series AR5, et al.*, March 2, 2012 (Ex. 5).

[31] Expert Declaration of Charles D. Cowan in Support of Plaintiff's Motion for Approval of Sample Design, *Federal Home Loan Bank of Chicago v. Banc of America Securities LLC et al.*, December 7, 2012 (Ex. 6).

Residential Funding Co. matter, Dr. Cowan revealed that plaintiff's counsel had selected the +/- 10 percent margin of error to be used (rather than a +/-5 percent margin of error that he also submitted for their consideration).[32]

21. Furthermore, in Exhibit 4 of his declaration, Dr. Cowan cites a Housing and Urban Development ("HUD") directive related to using "sampling to test loan origination and servicing for FHA-insured loans,"[33] which requires "a random sample that provides a 95% confidence level with 2% precision."[34] This document, which Dr. Cowan cites as evidence that statistical sampling is scientifically valid, states that a margin of error of +/-2 percent, not +/-10 percent, is required.

22. A margin of error of +/-10 percent (*i.e.*, a range of possible defect rates that can be 20 percentage points apart) is less precise than a margin of error of +/-5 percent (*i.e.*, a range of possible defect rates that can be 10 percentage points apart), and significantly less precise than a margin of error of +/-2 percent (*i.e.*, a range of possible defect rates that can be 4 percentage points apart). For example, assume that a sample of 100 loans is drawn and the resulting estimated defect rate is 30 percent. This indicates a margin of error of approximately 8.98 percent,[35] which means that 95 percent of the time, the true defect rate in the population would fall approximately in the range between 21.02 and 38.98 percent, where the upper bound is almost twice the lower bound.

23. A smaller margin of error requires a larger sample size. Dr. Cowan claims that quadrupling the sample size from 100 to 400 loans does not yield a commensurate reduction in the margin of error "across all possible percentages of [m]isrepresented [l]oans," because "as the defect rate approaches zero or 100 percent, the margin of error . . . . must also approach zero, regardless of sample size."[36] I find such a statement misleading because it suggests the "defect rate" will be near one of these two values. The percentage of allegedly

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[32] Transcript of Daubert Hearing, p. 72:14-23, *Massachusetts Mutual Life Insurance Company v. Residential Funding Company., LLC.*, No. 3:11-CV-30039 (PBS) (D. Mass. Oct. 24, 2013) (Ex. 7).

[33] Cowan Declaration, ¶48.

[34] Cowan Declaration, Exhibit 4, p. 1.

[35] The exact margin of error varies with the defect rate and reaches its maximum value of 10 percent when the defect rate is 50 percent.

[36] Cowan Declaration, ¶57

misrepresented loans cannot be known until a sample of loans has already been drawn and re-underwritten. Dr. Cowan provides no evidence that *ex ante*, one should expect the defect rate to approach zero or 100 percent. Even in Dr. Cowan's own account,

> [W]hen the estimated rate of Misrepresented Loans is 20 or 80 percent, the margins of error for a 95 percent confidence level are +/- 7.84 percent for a sample size of 100 loans and +/- 3.92 percent for a sample size of 400 loans. When the estimated defect rate is 10 or 90 percent, the margins of error for a 95 percent confidence level are +/- 5.88 percent for a sample size of 100 loans and +/- 2.94 percent for a sample size of 400 loans.[37]

24. This indicates that, regardless of the defect rate, when the margin of error is reduced from +/-10 percent to +/-5 percent, the width of the confidence level for the estimate of the population defect rate shrinks from 20 percent to 10 percent, that is, a 50 percent decline. As the confidence level "describes explicitly how reliable the sample estimate of the population is likely to be,"[38] a 50 percent reduction in the width of the confidence level suggests a doubling of the reliability of the sample estimate.

25. The Memorandum in Support of Motion for Approval of Plaintiff's Statistical Sampling Methodology ("Plaintiff's Memorandum") states that the cost of re-underwriting is between $300 and $400 per loan, or approximately $350 per loan on average.[39] The Cowan Declaration claims that increasing the sample size "imposes large costs without commensurate benefits in increased precision,"[40] but does not support that proposition with any information or reasoning regarding the trade-off between potential costs and benefits associated with a larger sample.

26. Based on Plaintiff's estimate of the re-underwriting costs, the benefits of a smaller margin of error clearly outweigh the costs. Dr. Cowan proposes a sample size of 100 loans for each of the 110 SLGs, for a total of 11,000 loans. To achieve a 5 percent maximum margin of error, had the sample size increased from 100 to 400 loans for each SLG, for a total sample size of

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[37] Cowan Declaration, ¶57

[38] Cowan Declaration, ¶34.

[39] Plaintiff's Memorandum, Dkt. No. 392, p. 4.

[40] Cowan Declaration, ¶55.

44,000 loans, the cost of re-underwriting would go from approximately $3.85 million to $15.40 million, an increase of $11.55 million.

27. Next, consider the "increased precision" in terms of dollar amount of allegedly misrepresented loans. If the estimates of the dollar amount of the allegedly misrepresented loans relate to relevant inquiries in the current matter, a margin of error of +/-10 percent may result in a range of potential outcomes that is too wide to be useful. I discuss this through some hypotheticals below.

28. According to the Complaint, Plaintiff purchased over $5.7 billion[41] of triple-A-rated certificates backed by mortgage loans from 110 SLGs, indicating that the principal amount of the underlying mortgage loans would be significantly more than $5.7 billion.[42] However, if one assumes, hypothetically, that the principal amount of the mortgage loans was only $5.7 billion and that 25 percent of the loans in the sample were defective, then the expected dollar amount of defective loans in the population could be estimated to be 25 percent of $5.7 billion, or $1.43 billion. Given a breach rate of 25 percent, a sample size of 100 loans would imply a 8.49 percent margin of error and a sample size of 400 loans a margin of error of 4.24 percent. For this $1.43 billion, a 8.49 percent margin of error would be approximately $120 million and a 4.24 percent margin of error would be approximately $60 million, yielding a difference of approximately $60 million when different margins of error are considered. Thus, the potential gain for Plaintiff to invest an additional $11.55 million in re-underwriting could be at least $60 million, or a net gain of at least $48 million and a reward-to-risk ratio of over 4 to 1.[43]

29. Assuming an average cost of $350 to underwrite each loan, the cost to Plaintiff to re-underwrite *all* loans would be approximately $75 million.[44] If all loans were re-underwritten, then defective loans can be determined exactly from the population with zero margin of

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[41] Complaint, ¶1

[42] Each SLG collateralizes several certificates. Since Plaintiff purchased only the highest rated tranches of each deal, it follows that the total principal of the underlying loans was much larger than the price of the certificates purchased by Plaintiff.

[43] And the more the total original mortgage balance was in excess of $5.7 billion as assumed in this hypothetical, the more precise or the larger the amount of gain from having a smaller margin of error.

[44] "There are over 215, 000 mortgage loans underlying the 111 Certificates of mortgage backed securities at issue in this case." (Plaintiff's Memorandum, p. 1)

error.[45]   Therefore, still assuming that the principal amount of the mortgage loans was $5.7 billion, with a 25 percent defective rate, the gain with a zero margin of error could be approximately $120 million (*i.e.*, reducing an 8.49 percent margin of error, or approximately $120 million, to zero) minus the $75 million re-underwriting cost, or net $45 million—a significant saving that Dr. Cowan does not refute, or even address.

VII.   Dr. Cowan's Failure to Describe His Extrapolation Methods Renders His Proposed Methodology Both Incomplete and Premature

30. Dr. Cowan does not provide his extrapolation methods, even though in the past he opined that sampling without extrapolation is "meaningless" and that the "process of extrapolation of the results from the sample to the population is an integral part of the planning for and *acceptance* of sampling as a viable scientific method." [46]   As a result, his methodology cannot withstand scientific scrutiny until more information is provided. Moreover, certain estimation and extrapolation methods discussed in the Cowan Declaration for "expository purposes"[47] can in fact result in biased or misleading outcomes, which raises different and serious concerns regarding the propriety of his proposal.

31. Dr. Cowan states that "[d]ifferent estimates will require different estimation and extrapolation methods," and that he intends to present the extrapolation method and results in a separate report when Plaintiff's affirmative non-sampling reports are due.[48] Dr. Cowan does not substantiate his assertion that extrapolation methods cannot be pre-specified before sampling results are obtained. If Dr. Cowan's view is that results from his current purported sampling method will be informative for him to decide on what "estimation and extrapolation methods" to present in the next stage of the litigation, [49] then it is not possible to assess the scientific reliability of his extrapolation method now, since key components are still missing.

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[45] Assuming no loan files are missing.

[46] Expert Report of Charles D. Cowan, Ph.D. Regarding the Selection of Statistically Valid Random Samples of Mortgage Loans for Fifteen FHFA Actions in *FHFA v. J. P. Morgan*, October 10, 2012 (Ex. 2), ¶64, emphasis added.

[47] Cowan Declaration, ¶67.

[48] Cowan Declaration, ¶67.

[49] Cowan Declaration, ¶67.

32. On the other hand, if Dr. Cowan only intends to use his sample to estimate the number of allegedly misrepresented loans in the population, as he seems to indicate in parts of his declaration, then it is not clear why he cannot commit to an extrapolation method at this time. It is my understanding that re-underwriting results based on Dr. Cowan's proposed sample have been extrapolated to estimate damages[50] or other variables of interest other than the number of defective loans in the population. As discussed above in Section V, Dr. Cowan's sample may not be sufficient for non-binary inquiries, and it is premature to discuss a sampling plan when the purpose of sampling or the inquiry to be addressed through sampling is not yet well-defined or will evolve over time. Adding to that uncertainty is Dr. Cowan's failure to articulate what measures or what features about the population he intends to estimate and extrapolate from the sample, and what specific extrapolation methodology he will use with regard to each. A sound sampling plan must include details on extrapolation before a sample is drawn. The failure to provide such details renders Dr. Cowan's current proposal incomplete and premature, and does not allow a full evaluation of whether his proposed methodologies are scientifically valid and reliable.

33. The Cowan Declaration states, "Once the samples of loans have been re-underwritten and determinations are made regarding each of the inquiries as set forth above in Paragraph 26, the next step is to extrapolate the results of such re-underwriting to the Population of loans."[51] Dr. Cowan sets forth some potential extrapolation methods for "expository purposes only," and claims that the extrapolation method that will ultimately be selected will be the one that "minimizes the margin of error."[52] But Dr. Cowan does not explain why it is appropriate here to choose extrapolation methods based on the margin of error, how different potential extrapolation methods would reduce the margin of error differently, or why such a selection cannot be made before the sample loans are re-underwritten. A full assessment of

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[50] *See, e.g.*, Affidavit of Dr. Charles D. Cowan in Further Support of Plaintiff's Motion *In Limine* Regarding Sampling, *MBIA Insurance Corporation v. Countrywide Home Loans Inc. et al.*, July 26, 2010 (Ex. 4), ¶¶114–129. Dr. Cowan further states in that Affidavit, "The use of extrapolation to estimate damages is an integral part of the planning for and acceptance of sampling as a viable scientific method" (¶115).

[51] Cowan Declaration, ¶64.

[52] Cowan Declaration, ¶67.

whether Dr. Cowan's methods are scientifically valid and reliable is not possible without this information.

34. In addition, one extrapolation method (*i.e.*, ratio estimator for a continuous variable[53]) that Dr. Cowan claims he may choose to use has a serious potential flaw, as discussed below. It is also not clear what kinds of continuous, rather than binary, variables Dr. Cowan intends to extrapolate. Hence, all other extrapolation strategies that may be considered should be presented together within the sampling proposal so that they, too, can be evaluated.[54]

35. Issues related to extrapolation from defect rates to other variables of potential interest (*e.g.*, dollar amount of defect loans or monetary damages) are inseparable from sample design. To measure the dollar amount of defect loans—which is not a binary outcome—with a desired margin of error, sample sizes significantly larger than what Dr. Cowan proposed may be necessary. Even at the margin of error of +/-10 percent, a measure Dr. Cowan has not justified, a sample size larger than 100 loans per SLG may be required to measure the dollar amount of defect loans.[55]

36. In lieu of a detailed discussion of his extrapolation methods, Dr. Cowan states, "The method that will ultimately be selected will be the one that minimizes the margin of error."[56] However, using the margin of error to choose among potential extrapolation methods is not meaningful if not all methods under consideration can yield unbiased estimates where the expected value of the estimator is equal to the true value in the population. Dr. Cowan does not explain what estimates he intends to use other than stating that "[d]ifferent estimates will

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[53] "Alternatively, for a continuous variable I may choose a ratio estimator that incorporates data known from the loan tapes used to define the population and to select the samples." Cowan Declaration, ¶67.

[54] Dr. Cowan states that the MBIA court has accepted as admissible the extrapolation methodology he formulated. Cowan Declaration, ¶9. However, it is my understanding that despite the court's ruling allowing the proposed sampling methodologies to be used at trial, the court noted that, "Defendants' assertions [that Plaintiff's proposed methodology to extrapolate results from the proposed sample to prove liability and damages are flawed], and the assertions of their experts, are not without merit," and "ma[de] no finding . . . that Plaintiff's method is without flaw or unsusceptible to challenge." 30 Misc.3d 1201(A), 2010 WL 5186702, at *5 (N.Y.Sup.) (Ex. 8). Thus, to the extent that the extrapolation methodologies that Dr. Cowan intends to consider for the current matter are similar to those he proposed in the MBIA matter, then as the MBIA court has suggested, those methodologies may be found to be flawed.

[55] As illustrated in Exhibit 1, the sample size will be influenced by various factors including the standard deviation of the loan amount within an SLG.

[56] Cowan Declaration, ¶67.

require different estimation and extrapolation methods."[57] Depending on what estimation methods are used, some estimates may be biased. If one is faced with choosing between two extrapolation methods where at least one of them involves a biased estimate, choosing the method that has the smallest margin of error is inadequate and unsound.

37. For example, consider the estimate of a measure that was allegedly misrepresented in the Offering Documents, weighted average LTV ("WLTV").[58] According to the Complaint, weighted average LTV reflects "the average of the LTVs for the mortgages in the pool, weighted by each mortgage's principal amount."[59] It is not clear how Dr. Cowan intends to obtain an unbiased estimate of WLTV. WLTV, or W*LTV, is a product of two variables, W (*i.e.*, the weight based on principal balance that each loan has in computing the WLTV) times LTV (*i.e.*, the LTV ratio of the loans involved in computing the WLTV).   The expected value of the product, W*LTV, is not necessarily the product of the expected values of W and LTV respectively. Even if W and LTV can each be estimated separately without bias, their product, W*LTV, may be a biased estimate[60] and may require a complex extrapolation strategy.

38. As another example, Dr. Cowan states that, for a continuous variable, he may choose "a ratio estimator that incorporates data known from the loan tapes used to define the population and to select the samples."[61] While Dr. Cowan does not specify *what* ratio estimator he intends to use, it is known that ratio estimators are generally biased.[62] If an estimator is biased, choosing it as the extrapolation method would be scientifically unsound even if it has the smallest margin of error. In fact, the generally recommended method is to compare estimators using mean squared error rather than margin of error, since mean squared error takes account of not only the standard deviation of the estimate (which determines the margin of error), but also the bias in the estimate.

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[57] Cowan Declaration, ¶67.

[58] Complaint, ¶340.

[59] Complaint, ¶860.

[60] The expected value of a product is also influenced by the covariance between the two variables.

[61] Cowan Declaration, ¶67.

[62] William G. Cochran, *Sampling Techniques*, 3rd ed. (Hoboken, NJ: John Wiley & Sons, 1977) (Ex. 9), p. 160.

39. Consider two extrapolation methods where one method results in an unbiased estimate of a 20 percent breach rate with a 10 percent margin of error, and the other method results in a biased estimate of a 40 percent breach rate with a 4 percent margin of error. Given that the first estimator is unbiased, the population breach rate is expected to have a 95 percent confidence interval between 10 and 30 percent. While the second method has a smaller margin of error, its associated defect rate estimate of 40 percent is biased by 20 percent. This biased estimator has a 95 percent confidence interval between 36 and 44 percent, which is completely outside the 95 percent confidence region where the population breach rate lies, demonstrating the potential flaws in choosing an extrapolation method based on the margin of error.

VIII.   There Is No Basis to Conclude That Dr. Cowan's Proposed Treatment of Missing Loan Files Is Scientifically Reliable

40. Dr. Cowan proposes a method to address the problem of missing loan files by creating a back-up sample of 100 loans for each SLG. Dr. Cowan states that, if any loan files are missing from his initial sample of loans per SLG, "substitutes will be available from the second set of 100 loans."[63]

41. However, Dr. Cowan does not define what a missing loan file is or how a decision will be made to declare a file missing.   For example, he does not explain whether "missing" means certain pages of the loan files are missing, or that the complete loan file is missing.

42. Furthermore, Dr. Cowan does not address fundamental statistical questions about how he will ascertain if the files are missing at random or not at random,[64] and whether or not following his proposed substitution for "missing loan files," his final sample can be indeed "random and unbiased." Dr. Cowan's failure to consider, or construct a proposal that can

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[63] Cowan Declaration, ¶4.

[64] A loan file is missing at random if the process that led it to be missing is not correlated to the variables of interest. For example, if loans that have high FICO scores are missing more often than loans with low FICO scores, then the loans are not missing at random since there is some correlation between its FICO score, a variable of interest, and the fact that loans are missing.

accommodate potential non-randomly missing loan files can lead to scientifically invalid results.

43. Statistical practitioners generally take the possibility of missing information or nonresponses into account when designing their sampling methodologies. For example, political pollsters know that not every phone call will be answered. To address this issue, pollsters will implement mechanisms to account for "nonresponses" in their sample design. For example, Pew Research states in its survey methodology,

> Nonresponse in telephone interview surveys can produce biases in survey-derived estimates. Survey participation tends to vary for different subgroups of the population, and these subgroups are likely to also vary on questions of substantive interest. To compensate for these known biases, the sample data are weighted for analysis.[65]

44. More specifically, to address the nonresponse issue, the sample is weighted for household size and demographic characteristics, among other considerations. Even then, Pew Research still cautions, "Weighting cannot eliminate every source of nonresponse bias."[66]

45. With respect to potential missing loan files, Dr. Cowan simply states, "The initial 100 loans are selected at random. The replacement of a loan in the initial sample if the loan file is missing involves selection of another loan at random."[67] There is no evidence to suggest that Dr. Cowan's proposed substitution mechanism can avoid causing a non-random sample because Dr. Cowan has not established that the non-missing files from which the sample is being chosen are not systematically different from the non-missing files. For example, it may be determined that loans for which the file is missing are less likely to reflect underwriting defects, which would mean that the loan with a file replacing the loan without a file is more likely to reflect a defect. In this situation, if loan files are not missing at

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[65] http://www.people-press.org/methodology/our-survey-methodology-in-detail/, accessed on March 6, 2014 (Ex. 10).

[66] http://www.people-press.org/methodology/our-survey-methodology-in-detail/, accessed on March 6, 2014 (Ex. 10).

[67] Cowan Declaration, ¶62.

random—and Dr. Cowan has provided no basis to believe they are—following Dr. Cowan's sampling procedure would create an upward bias in the estimate of the defect rate.

46. Furthermore, in these situations where loan files are not missing at random, the "population" from which a final sample can be drawn is best defined not as all of the loans in the SLG but as the sub-population of all loans in the SLG with non-missing loan files. Sampling cannot be used to infer anything about the population of missing loan files from the sampled population of non-missing loan files. In fact, in such situations, it is unclear how defect rate, liability, or damages can be extrapolated for the missing loan files. The Cowan Declaration is completely silent on this issue and is thus fundamentally flawed.

IX.   Dr. Cowan Does Not Adequately Sample Loans by Relevant Originators

47. Dr. Cowan states that he was instructed that the relevant populations are the SLGs for the Certificates that Plaintiff purchased.[68] Dr. Cowan further states that a sample size of 100 loans per SLG will allow a "reliability characterized by a 95 percent confidence level with a maximum margin of error of +/- 10 percent" for "each Population," *i.e.*, for each SLG.[69] However, Dr. Cowan ignores that relevant inquiries in the current matter may require a reliable estimate along certain characteristics within each SLG, such as the rate of underwriting defects relating to each originator.

48. Information in the Complaint and its appendices indicates that among the 110 SLGs at issue, 33 SLGs had at least two originators, 23 SLGs had at least three originators, and 3 SLGs had at least four originators. It is my understanding that the identity of a loan's originator can be a critical attribute that needs to be considered when evaluating whether or not a loan is defective. I understand that originators not only may follow different underwriting guidelines, but also may differently exercise their discretion to weigh compensating factors when considering exceptions to underwriting guidelines. For a given loan file, different originators, or the same originator following different guidelines, may make different

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[68] Cowan Declaration, ¶1.
[69] Cowan Declaration, ¶52.

decisions, and there is no reason *a priori* to believe that loans underwritten by different originators would have the same or similar defect rates.

49. Consequently, within an SLG, comparing loan files and the decisions made about them by different originators, or by the same originator following different guidelines, can be problematic because it ignores important differences in the population from which the sample is being drawn. It is also premature to treat SLGs as the relevant sampling populations: to the extent that loans within the same SLGs have been originated by different originators who followed different guidelines or employed different underwriting practices, it may be necessary to draw the sample by originator so that the desired sampling precision or reliability could be obtained for each originator within each SLG, an aspect Dr. Cowan fails to consider.

X.   Dr. Cowan's Proposed Stratification by FICO Score Is Flawed

50. Dr. Cowan uses FICO score as the only stratification variable within an SLG. According to Dr. Cowan, "decreases in margin of error may not materialize if the stratifying variable is not correlated to outcomes of interest."[70] Dr. Cowan does not substantiate his assertion that FICO score is "correlated to outcomes of interest" and thus an appropriate stratifying variable. Dr. Cowan states in conclusory fashion that the FICO score has been shown to be predictive of the riskiness of the loan and is highly unlikely to be misstated[71]—but Dr. Cowan does not explain how these features make the FICO score correlate with "outcomes of interest" like the number of allegedly misrepresented loans.

51. Furthermore, other than claiming that using more stratification variables will have a smaller and smaller impact in reducing margin of error, Dr. Cowan fails to explain why stratification by other loan factors or characteristics besides FICO would be inappropriate, when in other actions, his methodology has stratified samples by a number of loan characteristics, including

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[70] Cowan Declaration, ¶59.
[71] Cowan Declaration, ¶58.

the FICO score, CLTV ratio, and documentation type.[72] Generally speaking, more than five or six stratification variables provide small gains and complicate the sampling process. However, Dr. Cowan limits consideration to just one variable (FICO), and does not consider any other variables such as time of origination, geographical location, or originator as potential primary stratification variables. For example, in my opinion, a sampling strategy needs to specify a plan for stratification by originator. To the extent that originators follow different underwriting guidelines for different types of loans, one may need further stratification within an originator. As discussed in Section IX above, among the 110 SLGs at issue, loans in more than half of all the SLGs were associated with two or more originators. Dr. Cowan provides no evidence that stratifying by the FICO score alone would capture such differences across originators.
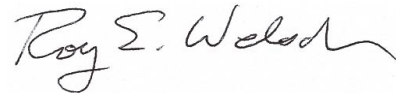
52. Dr. Cowan also claims that he will perform statistical tests to "ensure that the sample selected is representative of the population from which it was selected" along eleven key variables, including his stratification variable, FICO score.[73] However, such "representativeness" testing is not a substitute for proper stratification and cannot improve the margin of error.

53. Notably, Dr. Cowan's methodology does not even call for representativeness of the sample loans with respect to time of origination, geographical location, and originator—variables that can be potentially critical stratification attributes. Furthermore, Dr. Cowan fails to propose a remedy if it turns out that FICO, Dr. Cowan's only stratification variable, is unavailable , or if a potentially important variable (*e.g.*, LTV) turns out not to be well-represented based on his representativeness test.

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[72] See, for example, Affidavit of Dr. Charles D. Cowan in Further Support of Plaintiff's Motion *In Limine* Regarding Sampling, *MBIA Insurance Corporation v. Countrywide Home Loans Inc. et al.*, July 26, 2010 (Ex. 4).
[73] Cowan Declaration, ¶63.

XI.   Dr. Cowan Has Not Submitted Reproducible Methods and Procedures Which Precludes an Assessment of Their Scientific Reliability

54. In order to withstand scientific scrutiny, Dr. Cowan must have disclosed information that would allow others to replicate his results. This is the basic requirement of a scientific method and statistical science.[74]

55. This means that, when putting forth a sampling proposal, Dr. Cowan must provide the software and programs that will be utilized in drawing random samples and extrapolating the results to the populations. Dr. Cowan has not provided such information, including the random number generator.[75] Similarly, Dr. Cowan has not provided the data and computer programs for his claimed representativeness test of his sample.[76]

56. Without such data or computer programs, replicating Dr. Cowan's results and fully evaluating his methods is impossible at this time. His method cannot be deemed reliable without an assessment of this information. Further, to the extent this and other information critical to assessing the scientific validity of Dr. Cowan's proposal is provided at a future date, his method will likely require reassessment at that time.

Roy E. Welsch
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Roy E. Welsch, Ph.D.

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[74] Dr. Cowan states, "[r]esults from statistical sampling are replicable, meaning that statistical sampling meets the basic requirements of a scientific method." Cowan Declaration, ¶41.

[75] Dr. Cowan states that "[a] random number will be generated for each loan in each stratum, in a manner that ensures that each loan has an equal chance of being selected." Cowan Declaration, ¶61.

[76] Cowan Declaration, ¶63.